

**PATENT COOPERATION TREATY**

From the  
INTERNATIONAL SEARCHING AUTHORITY

REC'D 23 NOV 2005

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**WRITTEN OPINION OF THE INTERNATIONAL  
SEARCHING AUTHORITY**

(PCT Rule 43 bis.1)

Date of mailing (day/month/year)	
17. NOV 2005 (17 · 11 · 2005)	

Applicant's or agent's file reference  Hou In j 1		FOR FURTHER ACTION  see paragraph 2 below	
International application No.  PCT/IB2005/051474	International filing date (day/month/year)  05.May2005 (05.05.2005)	Priority date (day/month/year)  18.Jan2005 (18.01.2005)	
International Patent Classification (IPC) or both national classification and IPC  IPC <sup>7</sup> F02M61/06 F02M45/02			
Applicant  HOU, Deyang			

**1. This opinion contains indications relating to the following items:**

- Box No. I Basis of the opinion
- Box No.II Priority
- Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- Box No. IV Lack of unity of invention
- Box No. V Reasoned statement under Rule 43bis.1(a)(i)with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- Box No.VI Certain documents cited
- Box No. VII Certain defects in the international application
- Box No.VIII Certain observations on the international application

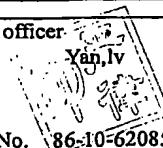
**2. FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1bis(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

**3. For further details, see notes to Form PCT/ISA/220.**

Name and mailing address of the ISA/CN  The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Date of completion of this opinion  20.Oct.2005 (20.10.2005)	Authorized officer  Xian.lv  Telephone No. 86-10-62085391
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WRITTEN OPINION OF THE  
INTERNATIONAL SEARCHING AUTHORITY

International application No.  
PCT/IB2005/051474

Box No. I Basis of the opinion

1. With regard to the language, this opinion has been established on the basis of:

the international application in the language in which it was filed  
 a translation of the international application into \_\_\_\_\_, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b)).

2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

a sequence listing  
 table(s) related to the sequence listing

b. format of material

on paper  
 in electronic form

c. time of filing/furnishing

contained in the international application as filed  
 filed together with the international application in electronic form  
 furnished subsequently to this Authority for the purposes of search

3.  In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

**WRITTEN OPINION OF THE  
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**Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

**1. Statement:**

Novelty (N)	Claims 1,3-9,12,15-16	YES
	Claims 2,10-11,13-14	NO
Inventive step (IS)	Claims 4,6,12	YES
	Claims 1-3,5,7-11,13-16	NO
Industrial applicability (IA)	Claims 1-16	YES
	Claims	NO

**2. Citations and explanations**

D1=US4528951A

Because the D1 discloses a mixed-mode fuel injector (1), which is a high-accuracy couple of components comprising: (i) a nozzle body (20), which has fuel passages, which has inner cylindrical spaces for receiving a movable part, (ii) a needle valve (21), which has a converging-diverging conical head, thereby guides the flow of fuel, which is movable back and forth and received in said nozzle body, wherein said needle valve is at a biased closing position or an opening position defined by driving means, (iii) a micro-variable-circular-orifice comprising a variable circular ring aperture between said needle valve (21d) and said nozzle body (20) and a micro-channel (20e), wherein it has means of discharging fuel in variable sprays through said micro-variable-circular-orifice by lifting said needle valve at different magnitudes (see fig.2 and column 4 line 21 to column 6 line 34). The difference between the solution defined by the claim 1 and the solution disclosed by the D1 is that there are a plurality of micro-channels. But the difference is well-known common knowledge, and it is obvious for a person skilled in the art to combine the D1 and the common knowledge to get the solution defined by the claim 1, and therefore the solution defined by the claim 1 does not meet the requirement of art 33 (3) PCT.

Because the D1 discloses a fuel injector (1), which is a high-accuracy couple of components comprising: (i) a nozzle body (20), which has fuel passages, which has inner cylindrical spaces for receiving a movable part, which has a conical surface close to its tip for guiding fuel sprays, (ii) a needle valve (21), which has a converging-diverging conical head, thereby guides the flow of fuel, which is movable back and forth and received in said nozzle body, wherein said needle valve is at a biased closing position or an opening position defined by driving means, (iii) a micro-variable-circular-orifice comprising a circular ring aperture between said needle valve (21d) and said nozzle body (20), wherein it has means of discharging fuel in variable sprays of conical shapes through said micro-variable-circular-orifice by lifting said needle valve at different magnitudes (see fig.2 and column 4 line 21 to column 6 line 34). The solution defined by the claim 2 is essentially disclosed by the D1, namely is not new and therefore the solution defined by the claim 2 does not meet the requirement of art 33 (2) PCT.

Because all the additional technical features in the claims 3, 5, 7-9, 11, 13-15 are either disclosed by D1 or the well-known common knowledge, in the situation that the claims refer to claim 1 which is lack of inventive step, the solutions defined by the claims 3, 5, 7-9, 11, 13-15 do not satisfy the requirement of art 33 (3) PCT.

Because all the additional technical features in the claims 10, 11, 13-14 are disclosed by D1, in the situation that the claims refer to claim 2 which is not new, the solutions defined by the claims 10, 11, 13-14 are not new and do not satisfy the requirement of art 33 (2) PCT.

Because the additional technical features in the claims 15 are well-known common knowledge, in the situation that the claim 15 refers to claim 2 which is not new, the solution defined by the claim 15 is obvious for a person skilled in the art and therefore does not satisfy the requirement of art 33 (3) PCT.

Because the D1 discloses a fuel injector (1), which has a micro-variable-circular-orifice (MVCO) comprising a variable circular ring aperture and a micro-channel (20e), wherein the MVCO is used as a sole orifice (see fig.2 and column 4 line 21 to column 6 line 34). The difference between the solution defined by the claim 16 and the solution disclosed by the D1 is that there are a plurality of micro-channels. But the difference is well-known common knowledge, and it is obvious for a person skilled in the art to combine the D1 and the common knowledge to get the solution defined by the claim 16, and therefore the solution defined by the claim 16 does not meet the requirement of art 33 (3) PCT.

Obviously, the solutions defined by the claims 1-16 can be made or used by technical personnel in the relevant field of technology and therefore they satisfy the requirement of art 33 (4) PCT.

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**Box No. VIII    Certain observations on the international application**

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

The claim 17 does not meet the requirement of clarity, because the extent of protection defined by the claim 17 is not clear.